



**ENVIRONMENTAL MANAGEMENT ACCOUNTING (EMA) IN
DISCLOSING ENVIRONMENTAL RISKS UNDER THE METRICS
AND TARGETS PILLAR OF THE TASK FORCE ON CLIMATE-
RELATED FINANCIAL DISCLOSURES (TCFD): ANALYSIS OF
CONTRIBUTION TO SDG 13 (CLIMATE ACTION) IN COAL
COMPANIES LISTED ON THE INDONESIA STOCK EXCHANGE
FOR THE PERIOD 2022–2024**

**AKUNTANSI MANAJEMEN LINGKUNGAN (EMA) DALAM
PENGUNGKAPAN RISIKO LINGKUNGAN DI BAWAH PILAR
METRIK DAN TARGET DARI SATUAN TUGAS PENGUNGKAPAN
KEUANGAN TERKAIT IKLIM (TCFD): ANALISIS KONTRIBUSI
TERHADAP SDG 13 (AKSI IKLIM) DI PERUSAHAAN BATU BARA
YANG TERDAFTAR DI BURSA EFEK INDONESIA
UNTUK PERIODE 2022–2024**

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Abstract

This study aims to analyze the role of Environmental Management Accounting (EMA) in disclosing environmental risks under the metrics and targets pillar of the Task Force on Climate-related Financial Disclosures (TCFD), as well as its contribution to the achievement of SDG 13 (Climate Action) in coal companies listed on the Indonesia Stock Exchange during 2022–2024. This research employs a descriptive quantitative approach using secondary data obtained from sustainability reports. The sample consists of 17 coal companies selected through purposive sampling, resulting in 51 observations. Data analysis is conducted using content analysis with a dummy scoring method based on 17 indicators of the TCFD metrics and targets pillar. The results indicate that the level of environmental risk disclosure shows an increasing trend, from 37.71% in 2022 to 48.44% in 2024. However, the overall level remains moderate, indicating that companies are still in a transition phase toward more mature climate reporting practices. Basic indicators such as total emissions and Scope 1 and Scope 2 emissions are widely disclosed, while advanced indicators such as Scope 3 emissions and emission reduction targets remain limited. The findings also reveal that the contribution to SDG 13 is uneven: strong in providing baseline emission data, moderate in emission intensity efficiency, and weak in comprehensive inventory and long-term mitigation strategies. Furthermore, companies are categorized into three groups—best practice, intermediate, and resistant—based on their level of disclosure and EMA readiness. Companies with more developed EMA systems demonstrate stronger contributions to climate action. Overall, the study concludes that the coal sector shows positive but



not yet optimal alignment with SDG 13, requiring improvements in methodological transparency, Scope 3 measurement, and science-based emission targets.

Keywords: Environmental Management Accounting, TCFD, Environmental Risk Disclosure, SDG 13, Coal Companies.

Abstrak

Penelitian ini bertujuan untuk menganalisis peran Environmental Management Accounting (EMA) dalam pengungkapan risiko lingkungan pada pilar metrics and targets Task Force on Climate-related Financial Disclosures (TCFD), serta kontribusinya terhadap pencapaian SDGs 13 (Climate Action) pada perusahaan batubara yang terdaftar di Bursa Efek Indonesia periode 2022–2024. Penelitian ini menggunakan pendekatan kuantitatif deskriptif dengan data sekunder yang diperoleh dari laporan keberlanjutan perusahaan. Sampel penelitian terdiri dari 17 perusahaan batubara yang dipilih menggunakan teknik purposive sampling dengan total 51 observasi. Teknik analisis data menggunakan content analysis dengan metode scoring dummy berdasarkan 17 indikator pada pilar metrics and targets TCFD. Hasil penelitian menunjukkan bahwa tingkat pengungkapan risiko lingkungan mengalami tren peningkatan dari 37,71% pada tahun 2022 menjadi 48,44% pada tahun 2024. Meskipun demikian, tingkat pengungkapan masih berada pada kategori sedang, yang menunjukkan bahwa perusahaan masih berada dalam tahap transisi menuju pelaporan iklim yang lebih matang. Indikator dasar seperti total emisi serta emisi Scope 1 dan Scope 2 telah banyak diungkapkan, sedangkan indikator lanjutan seperti Scope 3 dan target penurunan emisi masih terbatas. Temuan juga menunjukkan bahwa kontribusi terhadap SDGs 13 bersifat tidak merata, yaitu kuat pada penyediaan data emisi dasar, sedang pada efisiensi intensitas emisi, dan rendah pada inventarisasi komprehensif serta strategi mitigasi jangka panjang. Selain itu, perusahaan diklasifikasikan ke dalam tiga kelompok yaitu best practice, intermediate, dan resistensi berdasarkan tingkat pengungkapan dan kesiapan EMA. Perusahaan dengan sistem EMA yang lebih matang menunjukkan kontribusi yang lebih kuat terhadap aksi iklim. Secara keseluruhan, sektor batubara menunjukkan kontribusi yang positif namun belum optimal terhadap SDGs 13, sehingga diperlukan peningkatan pada aspek metodologi, pengukuran Scope 3, serta penetapan target emisi berbasis ilmiah.

Kata Kunci: Environmental Management Accounting, TCFD, Pengungkapan Risiko Lingkungan, SDGs 13, Perusahaan Batubara.

1. INTRODUCTION

Climate change has become one of the most pressing global challenges in recent decades. A report from the National Oceanic and Atmospheric Administration (NOAA) indicates that 2024 was recorded as the hottest year since global temperature records began in 1850, with the average global surface temperature reaching 1.29°C above the 20th-century average. This temperature increase is closely linked to the high level of greenhouse gas emissions, particularly from the energy sector. Data from the International Energy Agency (IEA) shows that CO₂ emissions from the energy sector reached 37.8 gigatons in 2024, with coal remaining one of the primary sources of global electricity generation. These conditions have driven various international initiatives, including the Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC), which aims to limit global temperature increases to below 2°C and supports the Sustainable Development Goals (SDGs), particularly Goal 13 on climate action.

In response to these global demands, the Indonesian government, through the Financial Services Authority (Otoritas Jasa Keuangan/OJK), issued Regulation No. 51/POJK.03/2017, requiring companies to prepare sustainability reports. These reports serve as a means of transparency for companies in disclosing the economic, social, and environmental impacts of their operational activities. In practice, various reporting standards are used to enhance the quality of climate-related disclosures,



one of which is the Task Force on Climate-related Financial Disclosures (TCFD) framework developed by the Financial Stability Board (FSB). This framework emphasizes four main pillars: governance, strategy, risk management, and metrics and targets, with the latter focusing on the disclosure of quantitative data such as greenhouse gas emissions, energy consumption, and corporate emission reduction targets.

The metrics and targets pillar in TCFD is closely related to the concept of Environmental Management Accounting (EMA), which functions to identify, measure, and report environmental information in both physical and monetary terms (Burrill et al., 2002). The information generated through EMA implementation can serve as a foundation for companies in managing environmental performance internally while also supporting transparency in climate risk disclosure to stakeholders. Therefore, the level of disclosure measured using the TCFD framework can reflect the extent to which companies contribute to achieving SDG 13 (Climate Action) and demonstrate their commitment to addressing climate change challenges.

2. RESEARCH METHOD

This study uses a descriptive quantitative approach to analyze the level of environmental risk disclosure in the sustainability reports of coal companies listed on the Indonesia Stock Exchange (IDX). The primary research variable is environmental risk disclosure based on metrics and targets within the Task Force on Climate-related Financial Disclosures (TCFD) framework. The following are the indicators used in this study:

Table 1. Indicators, Metrics, and Targets

Dimensions	Indicator
A. Disclose the metrics used by the company to assess climate-related risks and opportunities in line with its risk management strategy and processes.	A1: Disclosing the absolute gross greenhouse gas emissions generated during the reporting period A2: Disclosing the methodology and standards for calculating emissions
B. Disclose Scope 1, Scope 2, and, where appropriate, Scope 3 greenhouse gas (GHG) emissions, and associated risks.	B1: Disclosure of total Scope 1 GHG emissions B2: Disclosure of total Scope 2 GHG emissions B3: Disclosure of total Scope 3 GHG emissions B4: Scope 1 greenhouse gas emission intensity B5: Scope 2 greenhouse gas emission intensity B6: Scope 3 greenhouse gas emission intensity B7: For Scope 1 and Scope 2 emissions, an entity must disclose emissions separately for the consolidated accounting group (parent and subsidiary). B8: If an entity excludes Scope 3 greenhouse gas emissions, it must state the reason for the omission, for example, because it cannot obtain an appropriate measure.
C. Describes the targets used by the company to manage climate-related risks and opportunities	C1: Metrics used to assess progress towards achieving targets and achieving its strategic objectives. C2: Specific targets the entity has set to address climate-related risks and opportunities.



and performance against the targets.	<p>C3: Whether these targets are absolute targets or intensity targets.</p> <p>C4: The purpose of the target (e.g., mitigation, adaptation, or alignment with sectoral or science-based initiatives).</p> <p>C5: The target's implementation period.</p> <p>C6: The baseline period for measuring progress.</p> <p>C7: Any milestones or interim targets (Achievements against interim targets).</p>
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Source: TCFD 2017

The study population consisted of 46 coal sector companies with the sub-industry code A12. The sample was selected using a purposive sampling technique, with the criteria being coal production companies (A121), listed on the Indonesia Stock Exchange (IDX), and consistently publishing sustainability reports from 2022 to 2024. This resulted in 17 companies as samples. With a three-year observation period, a total of 51 observations were analyzed. This study used secondary data obtained from companies' sustainability reports, using content analysis to assess the level of disclosure based on the TCFD indicators. Each disclosure item was scored using a dummy score, with a value of 1 if the information was disclosed and 0 if not disclosed.

The level of compliance was then calculated using the following formula:

$$\text{Tingkat Pengungkapan} = \frac{\text{Jumlah indikator yang diungkapkan}}{\text{Jumlah indikator total}} \times 100\%$$

Next, the total score is calculated as a percentage. The total indicator criteria is 17. If the company only discloses 5 of the sub-indicators, then multiply 5/17 by 100%, resulting in a 29.41% level of compliance between the company's Metrics and Targets indicator disclosures.

For example:

$$\text{Tingkat Pengungkapan} = \frac{5}{17} \times 100\% = 29,41\%$$

The results of the disclosure score calculation will then be classified into several sections based on each company's level of disclosure, namely:

Table 2. Score Interval

Score Intervals	Category
0% - 20%	Very Low
21% - 40%	Low
41% - 60%	Currently
61% - 80%	Tall
81% - 100%	Very Hight

Source: Nelson & Meiden, 2023

The calculation results were used to compare the level of environmental risk disclosure among coal companies listed on the Indonesia Stock Exchange (IDX) during the 2022–2024 period. High levels of disclosure in the metrics and targets pillar reflect the company's commitment to climate risk management and support the achievement of SDG 13 Climate Action, particularly subtarget 13.2, which relates to the integration of climate policy into organizational strategy.

The following are the indicators for subtarget SDG 13.2:

Table 3. Details of SDG 13.2 Subtargets

SDGs 13.2	Climate Change Management
Indicator 13.2.1	The realization of the implementation of greenhouse gas (GHG) inventory, as well as monitoring, reporting and verification of GHG emissions reported in the Biennial Update Report (BUR) and National Communications documents.



Indicator 13.2.2	The amount of greenhouse gas (GHG) emissions per year
Indicator 13.2.2 (a)	Potential reduction in greenhouse gas (GHG) emissions
Indicator 13.2.2 (b)	Potential reduction in greenhouse gas (GHG) emission intensity

Source: (PPN/Bappenas, 2020)

3. RESULT AND DISCUSSION

The following is a summary of the sample company's disclosures during the research period:

TAHU N	KODE PERUSAHAAN																
	ABMM	ADMR	ADAR O	BSSR	BUMI	BYAN	COAL	GEMS	HRUM	INDY	ITMG	KKGI	MBAP	MCOL	PTBA	SMMT	TOBA
2022	70.59%	23.52%	29.41%	5.88%	70.59%	17.64%	0%	47.05%	58.82%	76.47%	76.47%	17.64%	11.76%	5.88%	64.70%	0%	64.70%
2023	70.59%	41.17%	64.70%	5.88%	70.59%	23.52%	0%	47.05%	58.82%	70.58%	82.35%	17.64%	17.64%	23.52%	70.58%	23.52%	58.82%
2024	70.59%	58.82%	64.70%	11.76%	70.59%	23.52%	29.41%	52.94%	58.82%	64.70%	64.70%	17.64%	52.94%	29.41%	70.58%	23.52%	58.82%

Figure 1. Summary of Sample Company Disclosures for 2022-2024

Source: Processed Data

In 2022, PT Indika Energy Tbk (INDY) and PT Indo Tambangraya Megah Tbk (ITMG) were the companies with the most comprehensive disclosure levels, each disclosing 13 metrics and targets. This demonstrates greater preparedness in providing structured and quantitative climate information. In contrast, PT Black Diamond Resources Tbk (COAL) and PT Golden Eagle Energy Tbk (SMMT) did not disclose these indicators. COAL stated in its 2023 sustainability report that it did not conduct emissions testing because its generator usage was still below 50 kVa, while SMMT only reported energy consumption without including emissions data or emission reduction targets.

In 2023, PT Indo Tambangraya Megah Tbk (ITMG) again led the company with the highest level of disclosure with 14 indicators, followed by PT ABM Investama Tbk (ABMM), PT Bumi Resources Tbk (BUMI), PT Indika Energy Tbk (INDY), and PT Bukit Asam Tbk (PTBA), each disclosing 12 indicators. The high level of disclosure in these companies reflects a stronger commitment to sustainability reporting practices and regulatory compliance. Conversely, COAL again recorded the lowest level of disclosure, as the company declared its operations to be emission-free, resulting in no emissions reporting.

In 2024, ITMG again led the transparency process with 13 indicators, followed by ABMM, BUMI, and INDY with 12 indicators each. Meanwhile, PT Baramulti Suksessarana Tbk (BSSR) demonstrated the lowest level of disclosure with only two indicators, despite having begun reporting its total emissions and reduction targets descriptively. COAL also improved by beginning to disclose several basic indicators related to emissions and reduction targets. Furthermore, PT Resource Alam Indonesia Tbk (KKGI) is in the bottom group, disclosing only three indicators during the 2022–2024 study period. This difference indicates a dynamic in climate risk disclosure practices among companies from year to year.

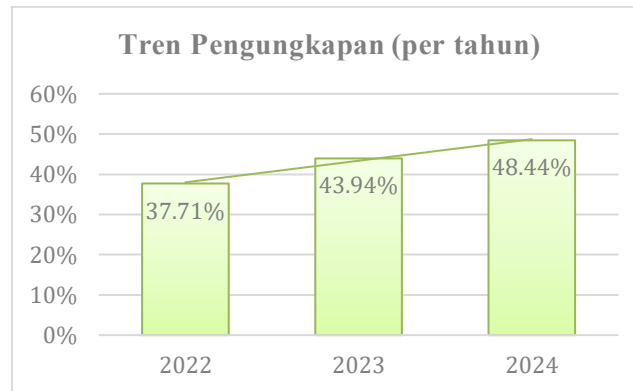


Figure 2. Annual Disclosure Trend

Source: Processed Data

The graph shows that the level of disclosure of TCFD metrics and targets among coal production companies experienced an increasing trend during the 2022–2024 period. Average disclosure rose from 37.71% in 2022 to 43.94% in 2023 and then rose again to 48.44% in 2024. This increase reflects a gradual improvement in the transparency of companies' climate risk and performance reporting in response to regulatory demands and stakeholder expectations.

Furthermore, to demonstrate the increase in disclosure related to indicators, the following is a summary of the percentage disclosure of the TCFD metrics and targets pillars:

Indikator	2022	2023	2024	Perubahan
M&T-A1	70,59%	88,23%	100,00%	+29,41%
M&T-A2	64,70%	82,35%	82,35%	+17,65%
M&T-B1	64,70%	82,35%	88,23%	+23,53%
M&T-B2	64,70%	70,58%	76,47%	+11,77%
M&T-B3	17,64%	17,64%	29,41%	+11,77%
M&T-B4	11,76%	11,76%	17,64%	+5,88%
M&T-B5	11,76%	5,88%	11,76%	0,00%
M&T-B6	0,00%	5,88%	0,00%	0,00%
M&T-B7	17,64%	23,52%	29,41%	+11,77%
M&T-B8	17,64%	29,41%	5,88%	-11,76%
M&T-C1	47,05%	41,17%	5,88%	-41,17%
M&T-C2	52,94%	52,94%	70,58%	+17,64%
M&T-C3	47,05%	52,94%	58,82%	+11,77%
M&T-C4	58,82%	64,70%	76,47%	+17,65%
M&T-C5	41,17%	47,05%	52,94%	+11,77%
M&T-C6	29,41%	41,17%	41,17%	+11,76%
M&T-C7	23,52%	29,41%	35,29%	+11,77%

Figure 3. Summary of Disclosure of Indicator Metrics and Target 2022-2024

Source: Processed Data

Analysis of the frequency of disclosure of indicator metrics and targets during the 2022–2024 period shows a consistent pattern between the dominance of basic indicators and low disclosure of advanced indicators. In 2022, indicator A1 was the most frequently disclosed, followed by A3, B1, and B2. While B6 was not disclosed at all, indicators such as B4–B5, as well as B3, B7, and B8, remained very low. This trend continued in 2023, where A1 remained dominant (15 companies), followed by A2, B1, and B2 with high compliance levels. B5 and B6 remained the lowest, reflecting limitations in measurement or information sensitivity. In 2024, there was a significant increase, with A1 being disclosed by all companies (17), followed by B1 and A2, and several indicators, such as B2, C2, and C4, also showing high frequency. However, indicators such as B6 remain undisclosed, followed by B5 and B8 which are very low, so that overall it shows that companies tend to prioritize the disclosure of



basic indicators which are general in nature, while more specific, strategic and complex indicators are still disclosed in a limited and selective manner.

Discussion

The trend analysis of metrics and targets disclosure shows a steady increase among coal sector companies in Indonesia during the 2022–2024 period, with the average disclosure rising from 37.71% to 48.44%. Despite an increase of 10.73%, the level remains suboptimal, indicating that companies are still in a transitional phase toward more mature climate reporting practices. The low level of disclosure in several indicators, particularly technical aspects such as emission intensity, long-term targets, and Scope 3 emissions, is not solely due to non-compliance but also reflects limitations in internal information systems, methodological readiness, and data availability. These findings are consistent with previous studies indicating that the quality of disclosure based on the Task Force on Climate-related Financial Disclosures (TCFD) remains at a moderate level, with the metrics and targets pillar identified as the weakest area (Daton & Meiden, 2024).

This gradual improvement can be explained by stakeholder pressure and the need for legitimacy, where companies increasingly enhance transparency to meet the expectations of investors, regulators, and society (Maria & Carmel, 2023; Huynh & Nguyen, 2024; Arsyilia & Suhartini, 2025). Large companies such as PT Bukit Asam Tbk (PTBA), PT Bumi Resources Tbk (BUMI), PT Indika Energy Tbk (INDY), and PT ABM Investama Tbk (ABMM) demonstrate more consistent disclosures as part of efforts to maintain social legitimacy in high-risk sectors. Furthermore, this trend reflects improved readiness in Environmental Management Accounting (EMA), particularly in its physical dimension, which serves as the basis for generating quantitative data on emissions and energy consumption (Bartolomeo et al., 2000; Burritt, 2023). Therefore, the disclosure pattern in the coal sector can be categorized as *improving but immature*, indicating clear progress while still depending on internal system readiness and the companies' capability to manage and report environmental data comprehensively.

Further analysis examines the alignment of empirical disclosure scores through mapping the metrics and targets indicators within the TCFD framework to the sub-targets of SDG 13 (Climate Action). For sub-target 13.2.1, which emphasizes greenhouse gas (GHG) inventory and monitoring, reporting, and verification (MRV) systems, indicators such as A2 (methodology) and B3 (Scope 3) play a crucial role; however, their disclosure remains low and inconsistent. This limitation suggests that although basic emission data such as A1, B1, and B2 are relatively available, contributions to a comprehensive GHG inventory remain partial due to incomplete emission coverage and limited methodological transparency.

In contrast, for sub-target 13.2.2, which focuses on total annual GHG emissions, the contribution of the coal sector is relatively strong. Indicators A1, B1, and B2 demonstrate high compliance levels, with A1 reaching 100% disclosure in 2024, indicating that companies are capable of providing emission data as a national baseline. However, contributions to sub-target 13.2.2(a), related to emission reduction potential, remain low due to limited disclosure of C-series indicators (C1–C7) concerning targets, projections, and mitigation strategies, reflecting constraints in long-term decarbonization planning.

Meanwhile, contributions to sub-target 13.2.2(b), related to emission intensity reduction, fall within a moderate category, as reflected in indicators B4 and B5, which show some improvement but remain inconsistent. Overall, the findings reveal an asymmetric contribution pattern: strong in providing baseline emission data, moderate in emission intensity efficiency, and weak in comprehensive inventory and long-term mitigation strategies. This indicates that the coal sector is still in a transitional phase toward more integrated climate action, requiring improvements in methodological rigor, emission coverage, and measurable decarbonization planning.

From the perspective of corporate contribution to SDG 13, the sampled companies can be classified into three categories: *best practice*, *intermediate*, and *resistant*, based on the readiness of their Environmental Management Accounting (EMA) systems, the completeness of emission disclosures, and their commitment to climate transition. The *best practice* group—comprising PT Bukit Asam Tbk



(PTBA), PT Bumi Resources Tbk (BUMI), PT Indika Energy Tbk (INDY), and PT ABM Investama Tbk (ABMM)—demonstrates the strongest contribution to SDG 13, supported by comprehensive disclosures, structured emission inventories, consistent quantitative data, and clearly defined long-term emission reduction targets. This reflects a higher level of EMA maturity, enabling companies not only to report emissions but also to plan and evaluate mitigation strategies effectively.

In contrast, the *intermediate* group—including ADMR, ADRO, BYAN, GEMS, HRUM, ITMG, MBAP, MCOL, SMMT, and TOBA—shows partial and inconsistent disclosure practices. These companies generally disclose only basic indicators such as total emissions or Scope 1 and Scope 2 emissions, without sufficient methodological clarity, intensity measurements, or long-term mitigation targets. Previous studies support this finding, indicating that companies tend to disclose general information while facing difficulties in reporting Scope 3 emissions due to the complexity of cross-supply chain coordination and methodological challenges (Indarto & Tantra, 2024; Graf-Vlachy & Hettler, 2024; Haalebos et al., 2024). Consequently, their contribution to SDG 13 remains limited to providing annual emission data without supporting strategic aspects such as emission reduction potential and carbon efficiency. This condition reflects a transitional phase, where companies respond to reporting demands but lack sufficient internal system readiness.

Meanwhile, the *resistant* group—comprising PT Black Diamond Resources Tbk (COAL), PT Baramulti Suksessarana Tbk (BSSR), and PT Resource Alam Indonesia Tbk (KKGJ)—shows the lowest level of disclosure and contribution. Limitations in emission inventory, measurement methodologies, and the absence of emission reduction targets result in minimal and non-structural contributions to SDG 13. Some companies do not consistently report emissions or lack MRV systems, thereby failing to support sub-targets related to inventory, mitigation, and emission efficiency. Overall, these findings highlight that the level of contribution to climate action is highly dependent on the readiness of internal systems, particularly the implementation of EMA as the foundation for climate risk reporting and management.

Overall, the study indicates that the contribution of the coal mining sector to achieving SDG 13 (Climate Action) is positive but not yet optimal, as reflected in disclosure levels that remain below 50%. At the sectoral level, progress is evident in the increased disclosure of basic indicators such as total emissions (A1), Scope 1 (B1), and Scope 2 (B2), supporting the provision of national emission inventories (13.2.2). However, limited disclosure of advanced indicators such as Scope 3 (B6) and emission reduction targets (C1–C7) indicates that contributions to comprehensive inventory (13.2.1) and long-term mitigation (13.2.2(a) and 13.2.2(b)) remain constrained.

Structurally, this condition reflects *partial alignment*, where the *best practice* group demonstrates strong contributions due to well-developed EMA systems, while the *intermediate* and *resistant* groups remain constrained by methodological, technical, and data availability challenges. Therefore, the sector can be characterized as *improving but not transformative*, requiring strengthened EMA integration, improved Scope 3 measurement, and the adoption of science-based emission targets to achieve full alignment with SDG 13.

4. CONCLUSION

Based on an analysis of 17 coal companies listed on the Indonesia Stock Exchange (IDX) during the 2022–2024 period, this study yields the following key conclusions:

1. The level of environmental risk disclosure based on the Task Force on Climate-related Financial Disclosures (TCFD) under the Metrics and Targets pillar shows an increasing trend from 37.71% (2022) to 48.44% (2024), with basic indicators such as total emissions (A1) and Scope 1 (B1) remaining high and consistent. However, advanced indicators such as Scope 3 (B6) and emission reduction targets (C-series) remain low, suggesting the coal sector is still in a transition phase toward mature climate reporting and has not yet been fully standardized.
2. Task Force on Climate-related Financial Disclosures (TCFD) disclosures in indicators A1, B1, B2, and B4 contribute to the achievement of SDG 13 Climate Action, particularly subtargets 13.2.1 and



- 13.2.2, with the Best Practice group (PTBA, BUMI, INDY, ABMM) demonstrating the strongest contribution through validated emission baselines, reduction targets, and strong EMA integration. However, the low level of disclosure regarding Scope 3 and long-term targets and emission intensity means the sector has not optimally supported subtargets 13.2.2(a) and 13.2.2(b), so its contribution remains at the partial alignment stage and does not fully support national climate change mitigation.
3. This study has limitations, namely the inconsistent reporting of emissions by all companies during the study period (for example, COAL in 2022–2023 did not produce emissions) which affects the stability of percentages and comparability of data between companies, as well as the research focus which is only on one pillar of the Task Force on Climate-related Financial Disclosures (TCFD) so that it does not provide a comprehensive picture of company readiness in facing climate change because it does not cover aspects of governance, strategy, and risk management.

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